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Quantifying transport properties by exchange matrix method

TATYANA KRASNOPOLSKAYA, Institute of Hydromechanics NASU, Kiev, Ukraine, VYACHESLAV MELESHKO, Kiev National Taras Shevchenko University, Kiev, Ukraine — The exchange matrix method is described to study of transport properties in chaotic geophysical flows. This study is important for applying in problems of pollutants transport (such as petroleum patches) in tidal flows and others. In order to construct this special exchange matrix (first suggested by Spencer & Wiley) we use an approximation of such flows made by Zimmerman, who adopted the idea of chaotic advection, first put forward by Aref. Then for a quantitative estimation of the transport properties we explore a coarse-grained density description introduced by Gibbs and Welander. Such coarse-grained representations over an investigation area, show a “residence place” for the pollutant material at any instant. The orbit expansion method, exploited an assumption that the contributions of tidal and residual currents are of different orders (the tidal is much stronger), does not give answers in many real situations. The exchange matrix can show transport of patches or particles from any place in the area under consideration to an arbitrary location in the tidal sea and time if it happens.

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